

WHAT IS CLAIMED IS:

1. An ultrasonic transducer driver comprising:
a giant magnetostrictive element,
5 a fastener for holding the giant magnetostrictive
element under mechanical pressure,
a first field generator for providing a magnetic bias
field,
a second field generator for providing a magnetic
10 drive field, and
a magnetic circuit for channelling the magnetic
fields in the magnetostrictive element.
2. The driver of claim 1 wherein the giant
15 magnetostrictive element is a rare-earth-alloy-based
material.
3. The driver of claim 1 wherein the giant
magnetostrictive element is Terfenol-D and its composites.
- 20 4. The driver of claim 1 wherein the giant
magnetostrictive element is cylindrical with a central
hole.

5. The driver of claim 1 wherein the giant magnetostrictive element is a composite comprising two or more rare-earth-based alloy parts separated from one another by a layer of passive polymeric material.

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6. The driver of claim 1 wherein the fastener is a threaded shaft and a nut made of nonmagnetic metallic material.

10 7. The driver of claim 1 wherein the first field generator is a permanent magnet.

8. The driver of claim 1 wherein the second field generator is an electric coil.

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9. The driver of claim 1 wherein the magnetic circuit is a magnetic enclosing circuit having a pair of magnetic return-path rings and a magnetic return-path cylinder made of high-permeability, high-resistivity and high-saturation
20 material.

10. An ultrasonic transducer for a bonding apparatus, the transducer comprising:

a horn having a bonding tool at a smaller end and a
25 mounting collar at an opposite end, and

a driver coupled to the horn, the driver comprising a giant magnetostrictive element, a fastener for holding the giant magnetostrictive element under mechanical pressure, a first field generator for providing a magnetic bias
5 field, a second field generator for providing a magnetic drive field, and a magnetic circuit for channelling the magnetic fields in the magnetostrictive element.

11. The driver of claim 10 wherein the giant
10 magnetostrictive element is a rare-earth-alloy-based material.

12. The driver of claim 10 wherein the giant
magnetostrictive element is Terfenol-D and its composites.
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13. The driver of claim 10 wherein the giant
magnetostrictive element is cylindrical with a central
hole.

20 14. The driver of claim 10 wherein the giant
magnetostrictive element is a composite comprising two or
more rare-earth-based alloy parts separated from one
another by a layer of passive polymeric material.

15. The driver of claim 10 wherein the fastener is a threaded shaft and a nut made of nonmagnetic metallic material.

5 16. The driver of claim 10 wherein the first field generator is a permanent magnet.

17. The driver of claim 10 wherein the second field generator is an electric coil.

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18. The driver of claim 10 wherein the magnetic circuit is a magnetic enclosing circuit having a pair of magnetic return-path rings and a magnetic return-path cylinder made of high-permeability, high-resistivity and high-saturation
15 material.